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Fragmentation, vorticesand phantom vortices in rotating Bose-Eistein Condensates MARIOS C. TSATSOS, University of Sao Paulo, STORM WEINER, University of California at Berkeley, AXEL LODE, University of Basel — Superfluids are distinguished from ordinary fluids by the quantized manner the rotation is manifested in them. Precisely, quantized vortices are known to appear in the bulk of a superfluid subject to external rotation. In this work we study a trapped ultracold Bose gas of N=100 atoms in two spatial dimensions that is eitherstirred by a rotating beam or by a rotating anisotropy. We use the time-dependent multi-configurational Hartree method for bosons, that extends the mainstream mean-field theory, to calculate the dynamics of the gas in real time. As the gas is rotated the wavefunction of the system changes symmetry and topology. Fragmentation accompanies the resonances and change of symmetry of the wavefunction of the gas. We see a series of resonances as the rotating frequencyis increased and a variety of different excitations. Most importantly, we identify a novel type of topological defect as a phantom vortex. A phantom vortex cannot be seen in the density of the gas but it leaves its signature in the correlation function. We conclude that fragmentation of the gas appears hand-in-hand with resonant absorption of energy and angular momentum from the external agent of rotation.

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